Field of the invention

The present invention relates to a procedure and a telecommunication system which makes possible using a personal telephone number in both fixed and mobile networks, as well as in cordless access systems connected to these networks.

Background of the invention

A technology of using one and the same personal telephone number recognizable in different telecommunications networks is known. For example, EP 0738093 A2 (to TELIA AB), which is incorporated herein by reference, describes the technology where one telephone number is associated with a subscriber in various different communications networks. A condition for using this personal number is a central network node located at or being in communication with the mentioned different networks, preferably PSTN, ISDN, GSM or other mobile networks such as NMT (Nordic Mobile Telephony). The central network node does not influence network functions, numbering schemes and terminals in these networks. When a call is directed to a subscriber associated with any of the mentioned telecommunications network or utilizing a cordless access system, the call (independent of which telecommunications network it emanates) is connected to this central network node which converts the received personal number to the specific number corresponding to the communications network at which the subscriber has registered himself/herself. Upon that conversion, the network node connects the call to the current access point which corresponds to the specific number.

Also, there is known a US patent 6,301,474 (to Openwave Technologies Inc.) which is incorporated hereby by reference, describing a mobility extended telecommunication application. The technology comprises an integrated wireless and wirelined network with central control, which has a programmed interface to translate between the different protocols of the wireless and the wirelined networks to allow for automatic redirection of a new incoming call that is about to be established between the wireless network and the wireline network.

I enclose copies of the two patent references for your information

(Shall we introduce the acronyms used in the US patent 6,301,474, for our further description?

Anyway, we have to build our own list of acronyms for understanding the drawings we are going to present later.)

The services proposed in the above patent publications are quite advanced. However, every user who intensively uses the phone , often encounters the situation when aconversation starts while using a fixed or cordless phone but, since the user must leave the premises, the conversation has to be stopped and, upon redialing, to be continued from a mobile phone. The users are also familiar with an opposite situation, when a communication session starts at a mobile phone and after a period of time could have been continued at a fixed or cordless phone (e.g. while obtaining a higher quality of service and/or while using more comfortable appliances at the premises reached), but the cumbersome operation of disconnecting and re-connecting prevents the user from making that switch.

Summary of the invention

The objects of the present invention, among which resolving the problems outlined above, will be explained as the description of the invention proceeds.

By an embodiment of the present invention there is provided a method for supporting re-routing, during a single communication session, from a mobile device (e.g. a cellular telephone and the like) to a non-mobile device (e.g. a desk telephone, a cordless telephone and the like), or vice versa, wherein each of the devices used is associated with a different communications network.

The method comprises:

providing an edge node device that is operatively associated with said mobile device, with said non-mobile device;

determining that both said mobile and non-mobile devices are located within a geographical proximity required to enable re-routing of a communication session being in progress on one of said devices, to be held via the other device;

at said edge node device, re-routing the communication session that is currently in progress and routed to one of said mobile and non-mobile devices, to the other of said mobile and non-mobile devices.

By a preferred embodiment of the invention, the edge node is operatively associated with at least one corresponding mobile (cellular) network and at least one private network, and is capable of supporting at least one protocol operative at the cellular network and at least one protocol operative at the private network.

Preferably, the method described above further comprises a step whereupon carrying the determination step, the subscriber receives an indication that he/she may switch to the other device. More preferably,

the re-routing step is carried out following a response received from the subscriber to that indication.

In a preferred embodiment of the invention, the edge node device is operatively connected with a mobile network, e.g. a cellular network, and is adapted to exchange digital signals with a cellular unit, e.g. a base station controller. Also, the edge node device is operatively connected with a plurality of subscribers, each having at least one non-mobile device. As will be appreciated by those skilled in the art, the latter connection can be made by applying one or more various technologies that are currently in use for access networks. Examples of such technologies are POTS (in which case the digital signal received at the edge node device is converted into an analogue signal, a POTS signal, and shall be forwarded to the non-mobile device as such), ATM (where the signal may be forwarded to the non-mobile device as a VoATM signal), DSL (where the signal may be forwarded to the non-mobile device as a VoDSL signal), IP (where the signal may be forwarded to the non-mobile device as a VoIP signal), and the like.

By another embodiment of the present invention, the non-mobile device is a cordless telephone (e.g. one that is adapted to operate in Digital European Cordless Telecommunication, "DECT", network). In which case, the step of determining preferably comprises identifying, by the base part of the cordless telephone, the presence of a mobile device which is currently engaged in a communication session within a geographical proximity to that base part, enabling the re-routing of the continued communication session while using the cordless telephone.

In accordance with yet another preferred embodiment, the step of determining comprises identifying the presence of an active mobile device by using a sensing device, e.g. a device that operates based on Hi-

Fi technology, bluetooth technology, etc. and notifying the edge node device of that identification. **(Where such a sensing device can be positioned? Should it comprise antenna means?)**

Preferably, when the presence of an active mobile device is identified by any of the above means, a message is sent through the non-mobile device to the node edge, notifying the latter about the presence of the active mobile device. More preferably, that message comprises indication of the mobile device identification (e.g. its number). Optionally, or in the alternative, the non-mobile device is pre-configured with one or more identifications of mobile devices, so that only communication sessions that are held while using these specific mobile devices, can be re-routed to the non-mobile device, when applicable.

As described above by one of the embodiments of the present invention, the edge node device is operatively connected with a mobile network, e.g. a cellular network. Preferably, the edge node device is capable of establishing a communication path between a subscriber using a non-mobile device and his/her destination via a non-POTS network, such as a mobile network, an IP network and the like **(Can the communication be established without a mobile network?).** Further, the edge node device is adapted, after establishing a communication session along this path, to re-route that communication session along a different path so that the session shall continue between the subscriber's destination and a mobile device that is to be used by the subscriber.

(Shai, Moty – don't we create the following two situations: 1) when the handheld mobile device is allocated in the private network, will the conversation be run some time both the mobile and the cordless up to the moment the user decides to take the cordless phone? May be it will be quite a long time? What happens after

switching to the cordless, does the mobile drop the call? 2) When the user starts speaking at home via the cordless telephone, does it mean that all that time the mobile phone (if it is in a standby position) will be also busy running the parallel conversation? Will the user be unreachable through the mobile when he speaks at home/in the office? If not, may be it is not so bad… But if somebody else from the family speaks by a fixed/cordless phone? Does it mean that any parallel conversation will immediately run on the cellular, say when it is in a standby position, or when it is put on? It would block the cellular phone…

I suggest a preliminary flow chart illustrating one possible solution to the described situations. It could be used as a basis for Fig. 4. Please check, correct and fulfill.)

The private network may comprise a number of fixed communication devices, one or more cordless communication devices, some of them connected in parallel. The private network is usually a LAN serving an office, a house, an apartment or the like **(OK? Can the Hot -spot in your slide be defined as a private network having one or more digital subscribers ? Is it cellular? Wireless - fixed? Can we use our new feature with it ?)**

In the simplest case, the mobile device is a mobile telephone device, the no-mobile communication device is a cordless telephone, and the communication session is a telephone call. However, both the mobile device and the cordless communication device may provide not only voice sessions, but ensure fax transmissions, data communications, multimedia sessions. It means that the handheld mobile communication device can be a personal computer having a cellular connection to

internet, a mobile phone with the fax and internet functionality, etc. **(OK? But how do we transfer the sessions if, for example, both the non-mobile phone and the computer are in use, and the user wants to leave?)**

The edge device, for example, may comprise a DSLAM serving said private network by supporting protocol(s) of the private network, and further equipped with antenna means **(Can be?)** and a hardware/software block (one or more cards) allowing the DSLAM to support protocol(s) of at least said cellular network; the hardware/software block comprising a unit capable of performing **(and/or controlling?)** transfer of a communication session in progress from the handheld mobile device to a non-mobile communication device and/or vice versa. **(Must the card be inserted in the edge device only? I mean, is it the only possibility to allocate the software?)**

(What else except for DSLAM? Antenna of a local loop? CPE i.e., Customer premises equipment by its key system, PBX, cordless system? A combination of CPE and DSLAM? Both the antenna and the CPE are positioned in the private networks and have the properties of node B. Where is DSLAM in Fig. 1 – the unit 24?)

Owing to the new functionality of the edge device, the private network actually becomes part of the cellular network.

It should therefore be noted that each type of service in the mentioned patent application, including voice, must be provided using digital formats. **(OK? But then, POTS network cannot be used, at least without the cordless access system?)** Moreover, when the communication session is transferred from a mobile device to a non-mobile communication device, the session continues to be transmitted via and supported by the cellular network, as it was made before switching to

the non-mobile device. **(What about the reverse transfer? Can the user start speaking using a fixed phone of a regular PSTN and then be automatically transferred to the mobile phone, say via the cordless ? In other words, can the regular non-digital service be switched to a digital cellular in one session?..)**

Though the user continues using the mobile (cellular) service when switching to the private network phone, it can be cost effective to both the service providers and the users, due to providing/enjoying the new useful feature. **(OK?)**

For the cellular network being……, the protocols to be supported by the edge device are……

For the private network being ……, the protocols to be supported by the edge device are…….

Must the edge node support protocols of other networks if they are connected to the private network via the cellular network ?

(Still, we have to try and explain, at least schematically, which protocols/programs could allow us to implement the proposed feature of transferring one session between cellular-cordless, and how (very briefly) it can be done: any signaling, commands or hanging on/off for approving the switching action? – for Figs. 4-5)

Brief description of the drawings

The invention will be further described with reference to the following non-limiting drawings, in which:

Fig. 1 is a pictorial representation of one particular example of a communications system implementing the proposed technology.

Fig. 2 schematically illustrates which communications protocols should be supported by an exemplary edge node shown in Fig. 1.

Fig. 3 illustrates a slightly different implementation of the proposed system, using another version of a control plane (**OK?)** for the cellular network **(Actually, it is not essential to our present invention, how the communication session is held in the cellular network - via RNC or via IMS. Correct? If it brings additional advantages to our case, please explain)**

Fig. 4 (please check, correct and complete the proposed sketch) – a schematic flow chart illustrating how a communication in progress can be transferred from a mobile communication device to a cordless communication device and vice versa.

Fig. 5 (please provide) – a schematic flow chart/block diagram Illustrating exchange of commands/signals between units of the system during the process of switching a communication session in process between a non-mobile device and a mobile device.

Detailed description of the preferred embodiments

Here the list of acronyms is to be inserted, to assist explanation of the drawings. Please provide the list and the explanations. The most important abbreviations are:

CPE (Customer Premises Equipment); RNC(Radio Network Controller); BRAS(?); POP(?Point of Presence?); Wi-Fi (wireless fixed?); R99 core; SGSN(Serving GPRS Support Node?), GGSN(Gateway GPRS Support Node), UMSC(??); UE(a mobile device?);

Various protocols – for which communication types/networks they are used?

IMS (IP multimedia subsystem?) , CSCF(Call Session Control Function?), MRF(Media Resource Function), MGCF(Media Gateway Control Function)

Fig. 1 illustrates a pictorial diagram of a combined communications networks system. The system comprises a local area network LAN 10 which contains a first private network 12 (say, a house network) comprising a cordless phone 14 and a cordless (wireless fixed ?) computer 16. Communication sessions to and from the private network 12 pass through the CPE 15 located in the house. LAN also comprises a second private network 18 **(OK?)** comprising one or more wireless communication devices, such as a computer 20 communicating via a wireless link to an antenna of a wireless local loop system **(OK?) .** According to the invention, the CPE 15 is an edge node of the private network 12 and has functionality of a cellular base station (node B), i.e. is capable of identifying, allocating and serving pre-determined cellular telephone numbers, including various services which can be provided by cellular equipment. **(OK? Does the CPE support protocols of both the cellular and the private networks?)** The same functionality of node B is provided to the antenna 22 which serves an edge node of the private network 18.

Communication sessions to/from the LAN 10 is transferred to outside networks via a local exchange **24 (DSLAM? Do the CPE and node 24 play part of the edge node device together?).**

The combined network system comprises, for example, a fixed network 26 with a routing junction 27 including BRAS, POP **(?????)** and a router. The routing junction 27 performs navigation of data incoming the fixed network 28, either to an ATM –based portion 28 of the fixed network 26

(i.e., the network operating in the format of Asynchronous Transfer Mode), or to an IP portion 30 (the network utilizing Internet Protocol), and vice versa.

Most important, the combined network system comprises at least one cellular network 40 which, for example, uses ATM format **(only?).** The cellular network 40 is connected to the LAN 10 via a Radio Network Controller RNC 42. **(What is the function of RNC in the present invention? Can it functionally be considered a part of edge node in the present description? Why the connecting RNC is the fixed RNC, and why there is also a mobile RNC? Can they replace one another in the scheme?)** The cellular network 40 may further be connected to other sub-networks, say such as IP/ATM or PSTN. **(OK?)**

The personal telephone number embedded/programmed in a mobile telephone 44 can be used within the cellular network 40 and also within the LAN 10, if the edge nodes 15 and 22 are provided with functionality of base stations of the cellular network, and the private number is recorded at the private networks. Moreover, the novel feature of transferring a communication session in progress can be provided if the edge nodes 15 and 22 of the private networks 12, 18 are respectively equipped with specifically designed hardware/software means (cards). **(Can unit 24 be equipped with these cards? How units 15 and 24 interact with one another?)**

Fig. 2 presents a pictorial representation of a variety of protocols which should be supported by the LAN edge nodes 15, 22, **(24?)** as well as by border nodes of other networks connected to the LAN 10. **(OK? PLEASE HELP to describe it. Do we have any special protocols**

among those illustrated, which enable implementation of the proposed feature?)

Fig. 3 illustrates how the combined network of Fig. 1 can be modified to comprise an integral control plane IMS **(IP Multimedia Subsystem - OK?)** via which the LAN 10 can be connected to the cellular network 40. **(Does the IMS perform any functions of the edge node? Is this configuration is more convenient for the method? Please explain the functions of IMS, and also functions of CSCF, MRF, MGCF – if relevant to the matter).**

Fig. 4 – (please check, correct, add other possible situations) In the proposed flow chart, the user permanently keeps a mobile phone carrying a personal telephone number. A private network (the private premises/office) comprises at least one communication device associated with this personal telephone number, i.e., kept by the edge node of the private network as a substitute of the mobile phone whenever the latter is allocated in the private network. Preferably, the cordless communication device should be personally assigned to the user only, to prevent transferring communication calls of different non-authorized persons to the mentioned mobile phone and vice versa.

According to one version of the method, whenever the mobile device is on and busy when the user enters the office, it is identified by the edge node or a sensing device of any type, the current call will be transferred to the cordless/fixed phone, and whenever the user picks up the call from the cordless, the mobile phone will be automatically switched off. During the time spent in the office, the mobile phone should remain switched off, otherwise the system will perceive it as a signal to

start transferring calls in parallel both to the cordless and to the mobile (regardless to which telephone the call arrives). Therefore, the user, when entering the private network, should better switch off the mobile phone with the personal number if he/she prefers using the fixed/cordless device in the private network instead of the mobile phone. When the user intends to leave the office, he/she switches the mobile phone on (even during a conversation on the fixed/cordless phone). In this case, whenever required, the user may pick up the same call from the mobile and leave the office, the call on the cordless phone will automatically be dropped. **(OK?)**

And if the private network comprises a cordless phone, a cordless fax, and a cordless computer, all associated with the same advanced mobile device? How call sessions/data sessions/fax sessions can be transferred between the mobile and (the computer, the fax?);

Fig. 5 ***please provide a functional diagram pointing out protocols/signaling/commands/approvals between the mobile device, non-mobile device, edge node, (sensing device?) required for performing the method.***

Preliminary claims:

Three independent claims

1. A method for supporting operation of a personal telephone number in a plurality of communications networks comprising at least a cellular network and a private network equipped with a cordless or wireless access system, wherein the cellular network comprises a number of base stations and serves a mobile communication device carrying said personal telephone number, while the private network serves at least one cordless/wireless communication device;

the method comprises:

- providing said private network with an edge node having a functionality of a base station of said cellular network and a capability of supporting protocols of both the cellular network and the private network,
- allocating the mobile communication device at the territory of said private network, and
- either transferring a communication session being in progress at said mobile communication device to a predetermined cordless/wireless communication device of said private network, and further dropping the communication session on the mobile device,
- or transferring a communication session, when in progress at a predetermined cordless communication device, to said mobile device, with further dropping the session on the cordless/wireless device.

2. A system for supporting operation of a personal telephone number in a plurality of communications networks comprising at least a cellular

network and a private network equipped with a cordless or wireless access system, wherein the cellular network comprises a number of base stations and serves, at least a mobile communication device carrying said personal telephone number, while the private network serves at least one cordless/wireless communication device;

the system comprises:

- said mobile communication device,
- at least one predetermined cordless/wireless communication device assigned to substitute said mobile communication device in said private network;
- an edge node having a functionality of a base station of said cellular network and a capability of supporting protocols of both the cellular network and the private network,

said edge node being capable of allocating the mobile communication device at the territory of said private network, and being operative to perform at least one of the two following operations:

- transferring a communication session being in progress at said mobile communication device to said at least one predetermined cordless/wireless communication device of said private network, to further drop the communication session on the mobile device,
- transferring a communication session, when in progress at said at least one predetermined cordless communication device, to said mobile device, with further dropping the session on said cordless/wireless device.

3. A computer program product having a computer readable medium with computer program logic recorded thereon for use in a system for supporting operation of a personal telephone number in a plurality of

communications networks comprising at least a cellular network and a private network equipped with a cordless or wireless access system, wherein the cellular network comprises a number of base stations and serves a mobile communication device carrying a personal telephone number, while the private network serves at least one cordless/wireless communication device;

the program product is intended to be used in conjunction with an edge node supporting protocols of both the cellular network and the private network and capable of allocating said mobile communication device in said private network, and comprises:

means for causing performance of at least one of the following operations, provided that the mobile communication device is allocated at the territory of the private network:

- transferring a communication session being in progress at said mobile communication device to a predetermined cordless/wireless communication device of said private network, to further drop the communication session on the mobile device,
- transferring a communication session, when in progress at a predetermined cordless communication device, to said mobile device, with further dropping the session on the cordless/wireless device.

Dependent claims:

- Private network – a PSTN with cordless access network; a wireless (?);

- DSLAM, or CPE, or … as an edge node;

- protocols of the cellular and the private for the edge node (if important);
- a specific algorithm of switching a session in progress.

Cross Network Subscriber

Via RNC to R99 Core, with Mobility

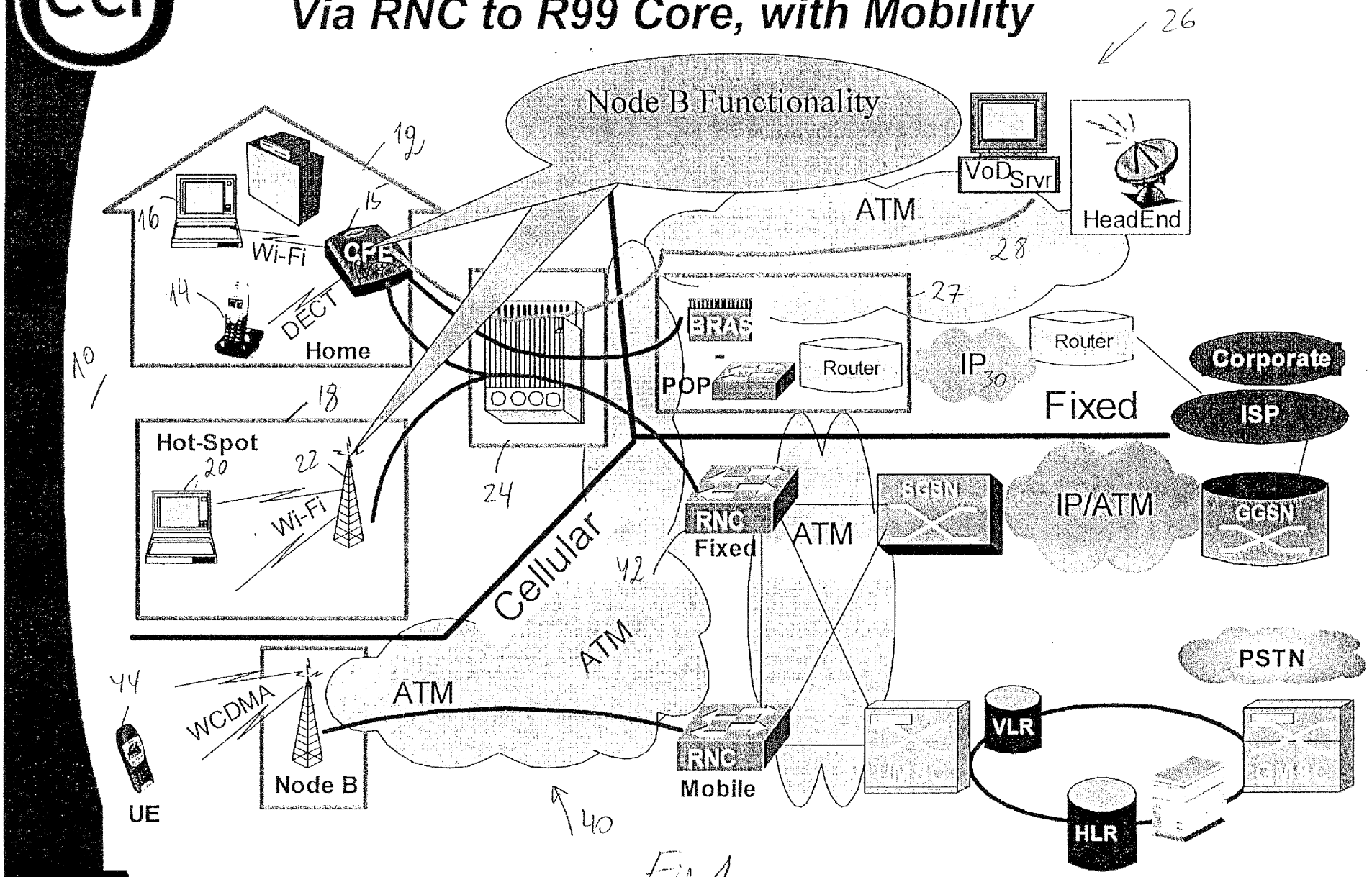

Fig. 1

Cross Network Subscriber

Via RNC to R99 Core, with Mobility

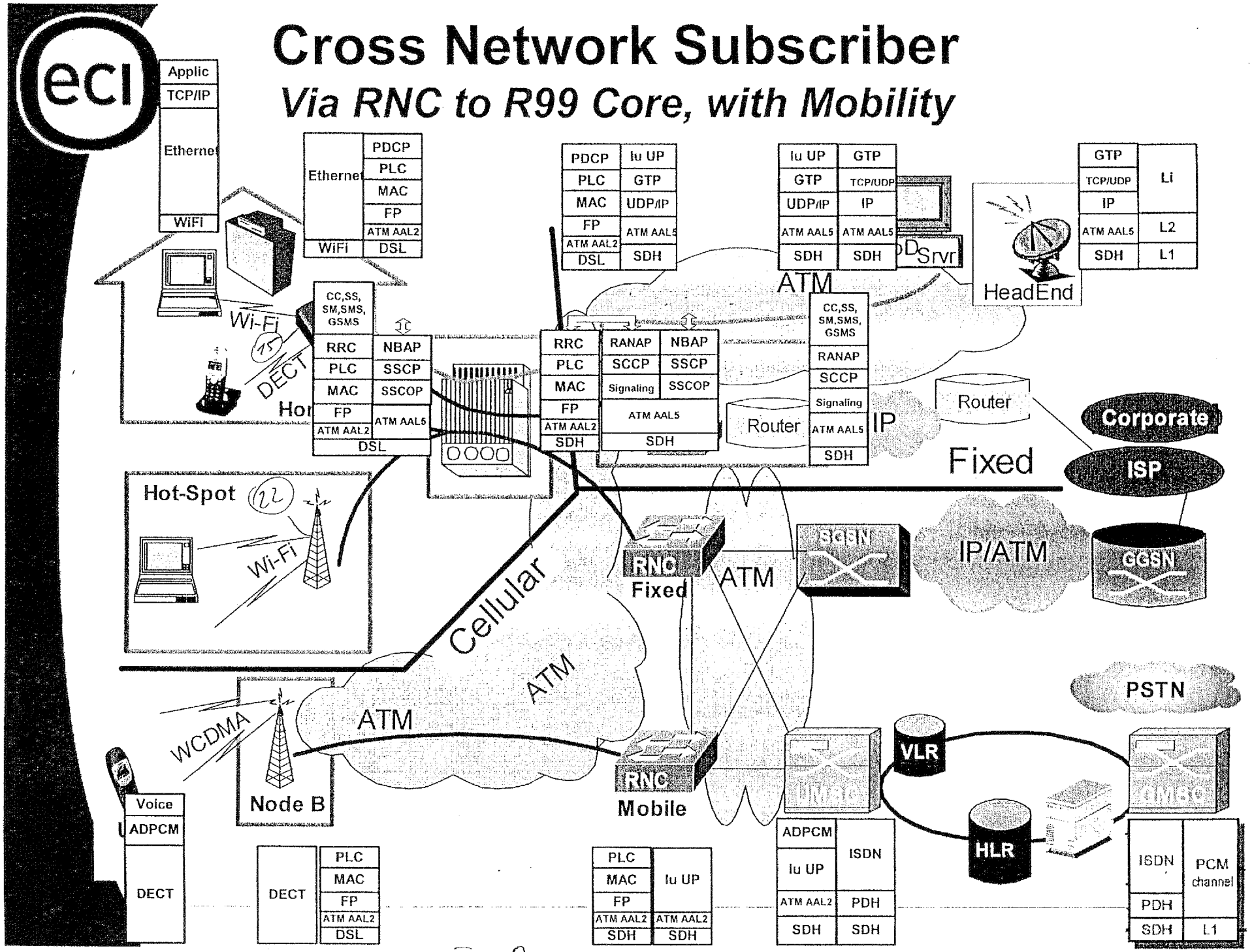

Fig. 2

Cross Network Subscriber

Via CSCF to R5/6 Core, with Mobility

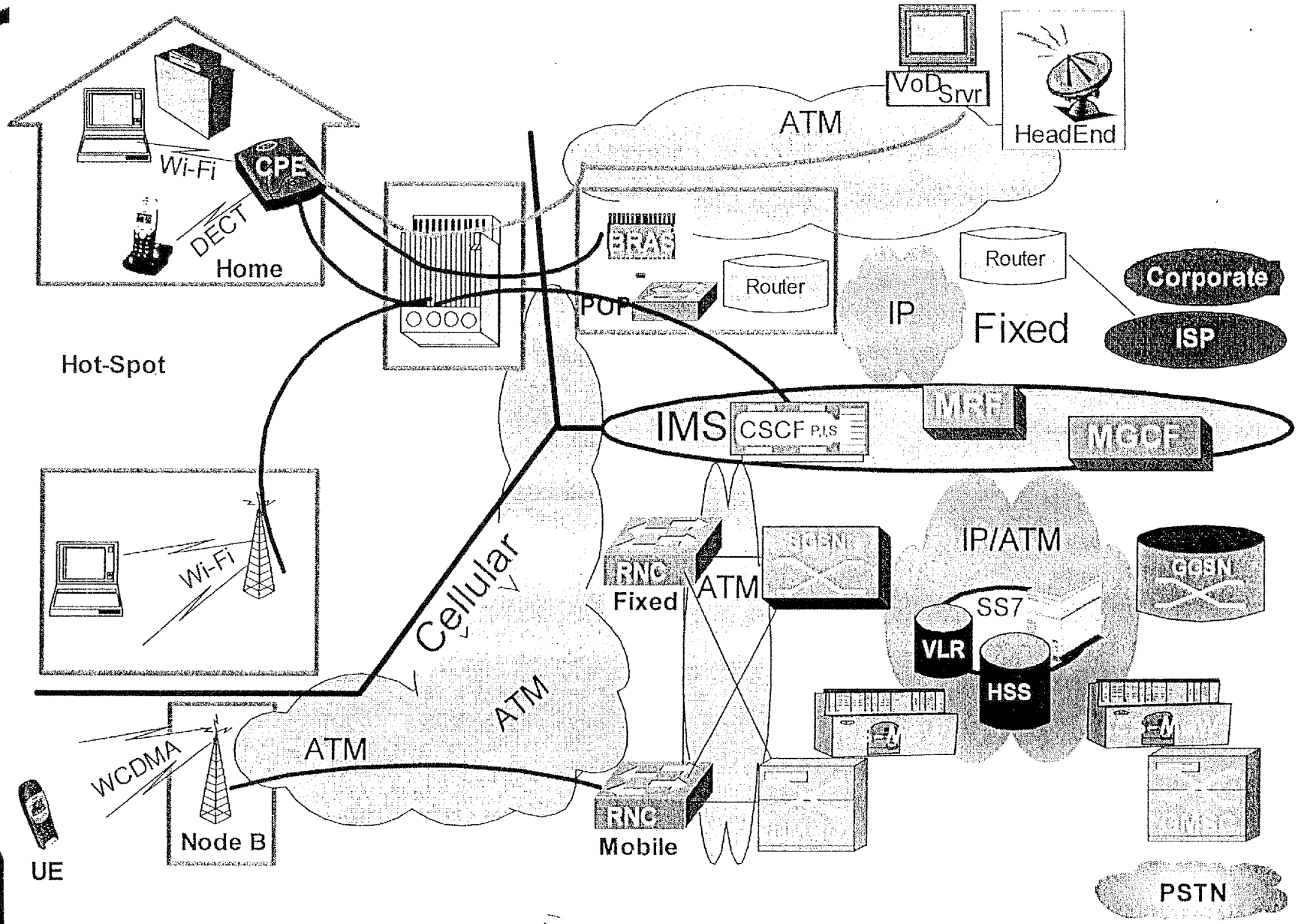

Fig. 3

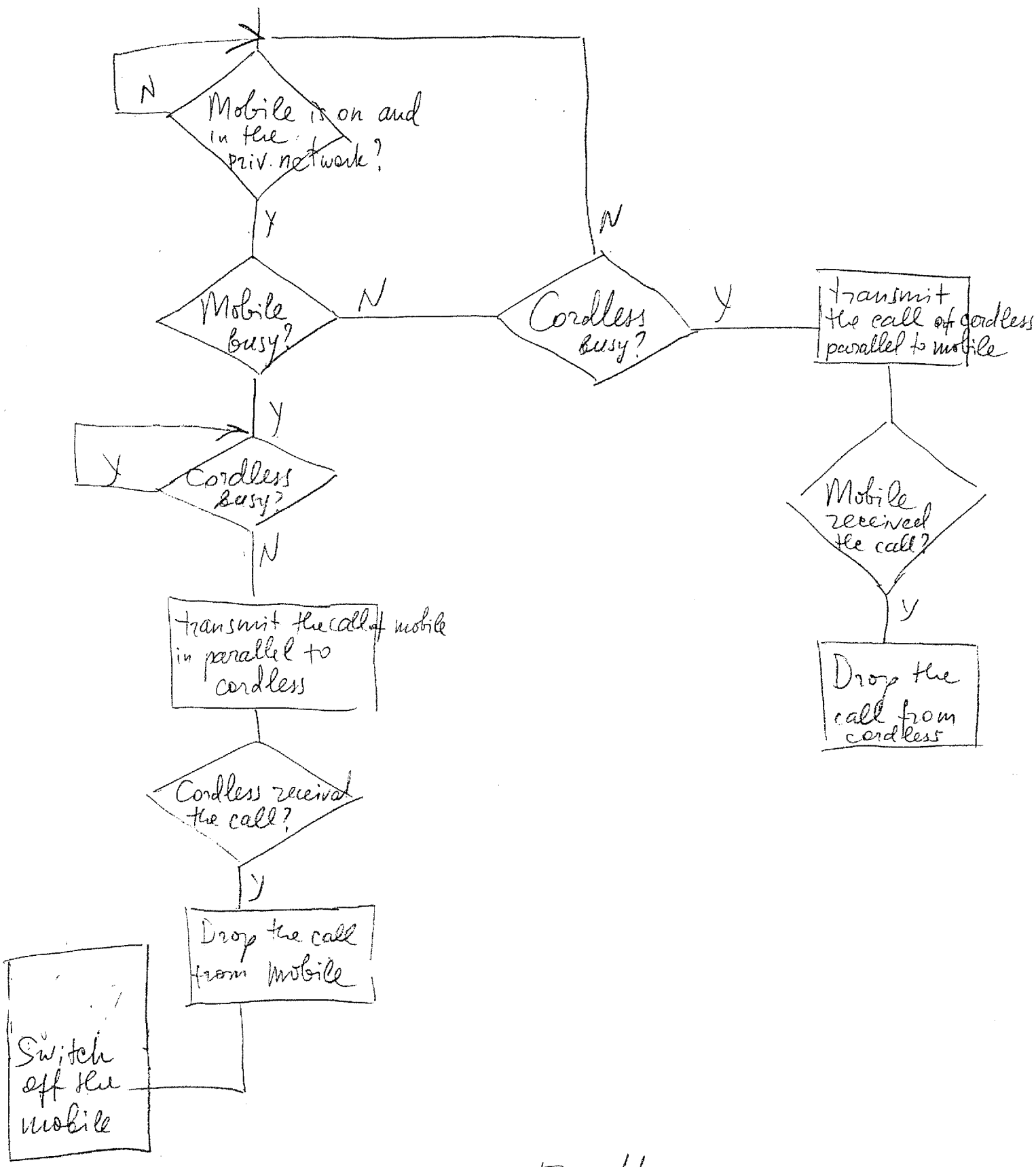
Mobile is on and in the priv. network?
N
Y
Mobile busy?
N
Y
Cordless busy?
Y
N
Transmit the call of cordless parallel to mobile
Mobile received the call?
Y
Drop the call from cordless
Cordless busy?
Y
N
Transmit the call of mobile in parallel to cordless
Cordless received the call?
Y
Drop the call from mobile
Switch off the mobile

Fig. 4